FUNDAMENTALS OF CHEMISTRY

(1) Define industrial chemistry and analytical chemistry.

Industrial chemistry can be defined as "The branch of chemistry which deals with the manufacturing of chemical compounds on commercial scale" e.g. preparation oxygen (O_2), chlorine (Cl_2), ammonia (NH_3) caustic soda (NaOH) etc.

While analytical chemistry is defined as "The branch of chemistry which deals with separation and analysis of a sample to identify its components".

(2) Define physical chemistry.

"The branch of chemistry which deals with the relationship between the composition and physical properties of matter and the changes in them, is called physical chemistry" e.g. behaviour of gases, liquids and solids etc.

(3) Define biochemistry and give its scope.

It deals with all the chemical processes taking place in living organisms**.** It has application in fields of medicine, food science etc.

(4) What is a mixture? Give one example.

Mixture is defined as "When elements or compounds are mixed in any ratio mixture is formed". For example air, ice cream, soil, rock wood etc.

(5) What is difference of homogeneous heterogeneous mixture?

Sr. No	Homogeneous mixture	Heterogeneous mixture
1	A mixture having throughout uniform composition is called homogeneous mixture.	A mixture having throughout non-uniform composition is called heterogeneous mixture.
2	Examples: Air, ice, cream, sugar, solution etc.	Examples: Wood, soil, rock, etc.

(6) What is relative atomic mass? How is it related to gram?

"The average mass of the atoms of an element as compared to **1/12th** the mass of an atom of C-12 isotope". The unit of relative atomic mass is called amu (atomic mass unit) and it is equal to

1 amu = 1.66×10^{-24} gram.

(7) Define empirical formula with an example.

The formula which shows the simplest whole number ratio of atoms present in a compound is called empirical formula. For example the empirical formula of benzene is CH.

(8) Define molecular formula with an example.

The formula which shows the actual number of atoms of each element in a molecule is called molecular formula. For example the molecular formula of benzene is C_6H_6.

(9) Determine the molecular mass of Nitric acid (HNO_3).

Atomic mass of H = 1 amu
Atomic mass of N = 14 amu
Atomic mass of O = 16 amu
Molecular formula = HNO_3
Molecular mass = ?
= 1 (At. Mass of H) + 1 (At. Mass of N) + 3 (At. Mass of O)
= $(1 \times 1) + (1 \times 14) + (3 \times 16)$
= 1 + 14 + 48

= 63 amu

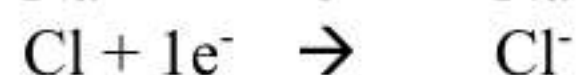
(10) Define free radical.

It is defined as "Atoms or group of atoms having odd number of electron i.e. unpaired electron is called free radical". e.g. $H^{\cdot}$, $Cl^{\cdot}$, $H_3C^{\cdot}$ etc.

(11) Define ion with an example. How they are formed?

It can be defined as "An atom or group of atoms having a charge on it". For example Na^+, Cl^- etc. These are formed when an electron is added or removed from the valance shell of an atom.

$Na \rightarrow Na^+ + 1e^-$

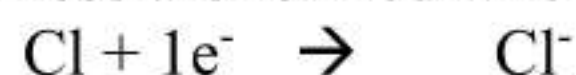
$Cl + 1e^- \rightarrow Cl^-$

(12) Define cations with an example. How they are formed?

An atom or group of atoms having positive charge on it is called cation. For example Na^+, K^+ etc. These are formed when atoms lose electrons from their valance shell.

$Na \rightarrow Na^+ + 1e^-$

(13) Define anions with an example. How they are formed?

An atom or group of atoms having negative charge on it is called anion. For example Cl^-, O^{2-} etc. These are formed when an atom gain electron.

$Cl + 1e^- \rightarrow Cl^-$

(14) Define types of molecules and give example of each. (Also A long Question).

Monoatomic molecules: A molecule consisting of one atom is called monoatomic molecule. For example neon (Ne) argon (Ar) etc.

Diatomic molecules: A molecule consisting of two atoms is called diatomic molecule. For example H_2, CO, O_2, etc.

Triatomic molecules: A molecule consisting of three atoms is called triatomic molecule. For example H_2O, CO_2, O_3 etc.

Polyatomic molecules: A molecule consisting of many atoms is called polyatomic molecule. For example methane (CH_4), benzene (C_6H_6) etc.

Homoatomic molecules: A molecule containing same type of atoms is called homoatomic molecule. For example Hydrogen (H_2) Sulphur (S_8) Ozone (O_3) Oxygen (O_2) etc.

Heteroatomic molecules: A molecule containing different type of atoms is called heteroatomic molecule. For example Carbon dioxide (CO_2), Water (H_2O) Ammonia (NH_3) Carbon monoxide (CO) etc.

i. Write down differences between compound and mixture.

ii. How chemical formula is written? Explain its three steps.

iii. Write-down significance of chemical formula.

iv. Differentiate between molecule and molecular ion.

STRUCTURE OF ATOMS

1. Give two characteristics of cathode rays. (Also A long Question).

- They cast a sharp shadow of an opaque (غیر شفاف) object placed in their path.
- They are deflected (مڑ جانا) towards positive plate in an electric filed.
- They raise the temperature of the body on which they fall.
- They travel in a straight line.

2. Write down any two properties of neutrons. (Also A long Question).

Neutrons has following properties

- Neutrons carry no charge i.e. they are neutral.
- They are highly penetrating.
- Their mass is nearly equal to mass of proton.
- They show no deflection in electric or magnetic field.

3. Give two properties of positive rays. (Also A long Question).

- They travel in a straight line opposite to the direction of cathode rays.
- The nature of these rays depends upon the nature of gas present in discharge tube.
- They show deflection in electric and magnetic field.
- Mass of these particles was found equal to that of proton.

4. For what purpose U-235 is used?

U-235 is used to get large amount of energy by controlled nuclear fission process in nuclear reactors. This energy can be used to generate electricity.

5. A patient has goiter (گلہڑ). How will it be detected?

OR

For what purpose Iodine-131 is used?

Iodine-131 is used to detect or diagnose (تشخیص کرنا) the goiter in thyroid gland.

6. What are the defects of Rutherford's atomic model?

Following are the defects in the Rutherford's atomic model.

- According to classical theory of radiation, electron being the charged particle should release energy continuously and ultimately fall into nucleus.
- If the electrons emit energy continuously, they should form a continuous spectrum, but they form line spectrum.

7. Write two observations of Rutherford atomic model.

- Almost all the particles passed through the foil undeflected.
- Out of 20,000 particles, only a few were deflected at fairly large angles and very few bounced back on hitting the gold foil.

8. Write down two postulates of Bohr's atomic theory. (Also A long Question).

- The hydrogen atom consist of a tiny nucleus and electrons are revolving in one of circular orbits having radius "r".
- Each orbit has a fixed energy that is quantized.
- Electrons can revolve only in those orbits which have fix angular momentum (mvr) i.e. mvr = n $\frac{h}{2\pi}$
- When an electron changes its shell, energy is absorbed or released.

9. Define term carbon dating.

"The method of age determination (معلوم کرنا) of old carbon containing objects (fossils) by measuring the radioactivity of C-14 in them is called carbon dating or radio-carbon dating".

10. Define electronic configuration.

OR

What is meant by electronic configuration?

It can be defined as "The distribution of electrons around the nucleus in different shells and subshells according to their increasing energy is called electronic configuration".

11. How many electrons are present in K, L, M and N shells of the atom?

Number of electrons in K shell = 2 Number of electrons in L shell = 8
Number of electrons in M shell = 18 Number of electrons in N shell = 32

12. How many electrons are present in s, p, d and f subshells of the atom?

Number of electrons in **s** subshell = 2 Number of electrons in **p** subshell = 6
Number of electrons in **d** subshell = 10 Number of electrons in **f** subshell = 14

13. Write the electronic configuration of Hydrogen, boron, nitrogen, oxygen, sodium, aluminium, Al^{3+} ion and phosphorus?

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The electronic configuration of **hydrogen** is **$1s^1$.**
The atomic number of Boron = 5
Electronic configuration of **boron** is **$1s^2, 2s^2, 2p^1$**
The atomic number of Nitrogen = 7
Electronic configuration of **Nitrogen** is **$1s^2, 2s^2, 2p^3$**
The atomic number of Oxygen = 8
Electronic configuration of **Oxygen** is **$1s^2, 2s^2, 2p^4$**
The atomic number of Sodium = 11
Electronic configuration of **sodium** is **$1s^2, 2s^2, 2p^6, 3s^1$**
The atomic number of Aluminium = 13
Electronic configuration of **aluminium** is **$1s^2, 2s^2, 2p^6, 3s^2, 3p^1$**
Electronic configuration of **Al^{3+} ion** is **$1s^2, 2s^2, 2p^6$**
The atomic number of phosphorus = 15
Electronic configuration **phosphorus** is **$1s^2, 2s^2, 2p^6, 3s^2, 3p^3$**

14. Write down two isotopes of followings:
Hydrogen, Chlorine, Uranium Oxygen, and Carbon.

There are following isotopes of Chlorine Uranium Oxygen and Carbon.

$^{35}_{17}Cl$ $^{37}_{17}Cl$, $^{234}_{92}U$ $^{235}_{92}U$ $^{238}_{92}U$ $^{16}_{8}O$ $^{17}_{8}O$ $^{18}_{8}O$ $^{12}_{6}C$ $^{13}_{6}C$ $^{14}_{6}C$

Isotopes of hydrogen.

Protium ($^{1}_{1}H$) Deuterium ($^{2}_{1}H$) Tritium ($^{3}_{1}H$)

LONG QUESTIONS

I. Describe the result of the experiments of Rutherford.

II. Write down postulates of Bohr's atomic theory. (جواب اوپر مختصر سوالوں کے ساتھ دیا گیا ہے)

III. Write properties of cathode rays. (جواب اوپر مختصر سوالوں کے ساتھ دیا گیا ہے)

IV. Discuss uses of isotopes in detail.

PERIODIC TABLE AND PERIODICITY OF PROPERTIES

(1) Why are noble gases not reactive?

The noble gases are not reactive because they have completely filled valance shells. Therefore they are not reactive.

(2) What is the difference b/w Mendeleev's periodic law and modern periodic law?

Sr. No	Mendeleev's periodic law	Modern periodic law
1	The properties of the elements are periodic function of their atomic masses.	The properties of the elements are periodic function of their atomic numbers.
2	Mendeleev's periodic law does not show the position of isotopes.	There is no need of separate position of isotopes.

(3) Write down demerits of Mendeleev's periodic table.

Mendeleev's periodic law does not show the position of isotopes moreover certain elements are placed in wrong order.

(4) Write down any two salient features of long form of periodic table.

- This table consist of seven horizontal rows called periods.
- Elements of a period show different properties.

(5) Define groups and periods in the periodic table?

Groups:

The vertical columns in the periodic table are called groups. There are total eighteen (18) groups in the modern periodic table.

Periods:

The horizontal rows in the periodic table are called periods. There are total seven (7) periods in the modern periodic table.

(6) What are Dobereiner's triads? Give example.

"In Dobereiner's triads the central element had atomic mass average of the other two elements". For example

Li (7) Na (23) K (39)   Average At. Mass = $\frac{7+39}{2}$ = 23

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(7) Describe Newlands Law of octaves.

According to Newlands, "When elements are arranged in increasing order of their atomic masses then properties of every eighth (8^{th}) element are similar to first one". For example Li and Na has same properties.

(8) Define atomic radius? Write its trend in groups and periods.

"Half of the distance between the nuclei of the two bonded atoms is called atomic radius". For example the atomic radius of carbon is 77 pm.

In period:

The atomic size decreases in a period because effective nuclear charge increases gradually and shell number do not increase.

In groups:

The atomic size increases in a group because shielding effect increases and number of shells also increases.

(9) Define ionization energy. ? Write its trend in groups and periods.

"The amount of energy required to remove the most loosely bound electron from the valance shell of an isolated gaseous atom is called ionization energy". For example

$$Na \rightarrow Na^+ + e^- \qquad \Delta H = +496 \text{ kJ/mol}$$

It energy increases in a period because the atomic size decreases in a period, while it decreases in a group because atomic size increases.

(10) Define electron affinity. Write its trend in groups and periods.

"The amount of energy released when an electron is added in the valance shell of an isolated gaseous atom is called electron affinity". For example

$$F + e^- \rightarrow F^- \qquad \Delta H = -328 \text{ kJ/mol}$$

It increases in a period because the atomic size decreases in a period, while it decreases in a group because atomic size increases.

(11) Define electronegativity. Write its trend in groups and periods.

It is defined as "The ability of an atom to attract the shared electron pair towards itself in a molecule". It increases in a group due to increases in number of shells. While it decreases in a period because number of shells remains constant.

(12) What is shielding effect? Write its trend in groups and periods.

The electron present in inner shells screen or shield (چھپا دینا یا کم کر دینا) the force of attraction of nucleus felt by the valance shell electrons. This is called shielding effect.

Trend:

It increases in a group due to increases in number of shells. While it decreases in a period because number of shells remains constant.

(13) Write the name or symbols of four noble gases.

Name of noble gas	Symbol	Name of noble gas	Symbol
Helium	He	Neon	Ne
Argon	Ar	Krypton	Kr
Xenon	Xe	Radon	Rn

(14) Write names of any four elements or symbols of first group of periodic table.

Name of element	Symbol	Name of element	Symbol
Hydrogen	H	Lithium	Li
Sodium	Na	Potassium	K
Rubidium	Rb	Cesium	Cs
Francium	Fr		

(15) Write the symbols of any four elements of halogen group.

Name of noble gas	Symbol	Name of noble gas	Symbol
Fluorine	F	Chlorine	Cl
Bromine	Br	Iodine	I
Astatine	At		

STRUCTURE OF MOLECULES

(1) Why do atoms react?

Those atoms which do not have 2 or 8 electrons in their valance shell they lose, gain or share electrons to complete their valence shell like noble gases. Therefore atoms react with each other.

(2) Metals are good conductor of electricity. Why?

Metals are good conductors of electricity in solid or liquid state due to presence of free or mobile electrons in them.

(3) Ionic compounds conduct electricity in solution or molten form. Why?

Ionic compounds conduct electricity in solution or molten form due to presence of free ions in molten or solution form.

(4) Differentiate b/w lone pair and bond pair of electrons?

Sr. No	Lone pair	Bond pair
1	The electron pair available on an atom is known as lone pair.	The electron pair which is involved in bonding is known as bond pair.
2	For example: - In ammonia $:NH_3$ there is ***one lone pair***.	In NH_3 there are three bond pair. H, :N•×H, H

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(5) What is the difference polar and non-polar covalent bonds?

Sr. No	Polar Covalent bond	Non-Polar Covalent bond
1	A covalent bond in which the shared electron pair is ***not equally attracted*** between two bonded atoms is called polar covalent bond.	A covalent bond in which the shared electron pair ***is equally attracted*** between two bonded atoms is called non-polar covalent bond.
2	For example bond in HCl $H^{\delta+}$ —— $Cl^{\delta-}$ is polar in nature.	For example bond in H_2 is non-polar in nature H —— H

(6) Why does ice float on water?

Ice float on water because the density of ice is less than water.

(7) What are intermolecular forces? Give one example.

The forces of attraction which are present between molecules are called intermolecular forces as shown in HCl molecules.

Intermolecular forces

$H^{\delta+}$—— $Cl^{\delta-}$ ---- $H^{\delta+}$—— $Cl^{\delta-}$ ---- $H^{\delta+}$—— $Cl^{\delta-}$ ---- $H^{\delta+}$—— $Cl^{\delta-}$

(8) What do you mean by malleability and ductility?

"The property of metals by virtue of which a metal can be rolled into sheets is called malleability".
"The property of metals by virtue of which a metal can be drawn into wires is called ductility".

(9) Define chemical bond. Write names of four different types.

"The force of attraction between atoms which holds them together in a substance".
There are following types of chemical bond.

- **i.** Ionic bond
- **ii.** Covalent bond
- **iii.** Coordinate covalent bond
- **iv.** Metallic bond

(10) What is metallic bond?

A bond formed between metal atoms (positively charged ions) due to mobile or free electrons is called metallic bond.

(11) Define octet rule and duplet rule.

Octet rule:

"Attaining EIGHT electrons in the valence shell is called octet rule". For example noble gases.

Duplet rule:

"Attaining TWO electrons in the valence shell is called duplet rule". For example Hydrogen and Helium.

(12) Write any two properties of ionic compounds.

- They have high melting and boiling points.
- Mostly they are soluble in polar solvents like water (H_2O).

(13) Write any two properties covalent compound.

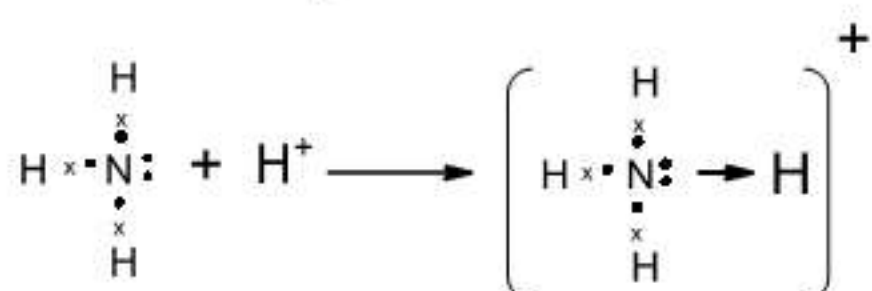
- They have oftenly low melting and boiling points.
- They are bad conductors of electricity.

(14) Write two physical properties of metals.

- They have high melting and boiling points.
- They are good conductor of heat and electricity.

(15) Define the co-ordinate covalent bond. Give one example.

The type of covalent bonding in which the bond pair of electrons is donated only by one bonded atom. For example

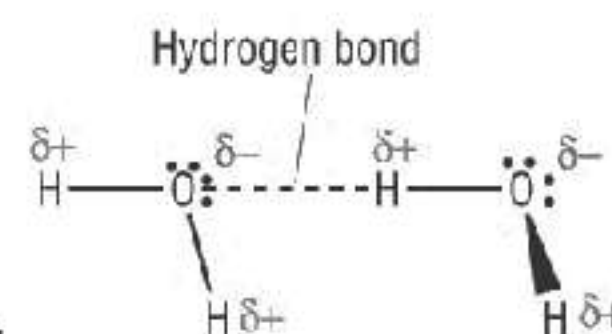
$$NH_3 + H^+ \longrightarrow [H_3N \rightarrow H]^+$$

(16) Define covalent bond. Give one example.

The type of bond which is formed by mutual sharing of electrons is called covalent bond. For example H-H, O=O, H-Cl.

(17) Define hydrogen bonding. Show the hydrogen bonding in water molecule.

The force of attraction which is present between partial positive hydrogen atom of one molecule and partial negative highly electronegative atom of other molecule is known as hydrogen bonding. It is shown by dotted line (---) in water molecule.

Hydrogen bond

$H^{\delta+}—O^{\delta-}(—H^{\delta+}) \cdots H^{\delta+}—O^{\delta-}—H^{\delta+}$

LONG QUESTIONS

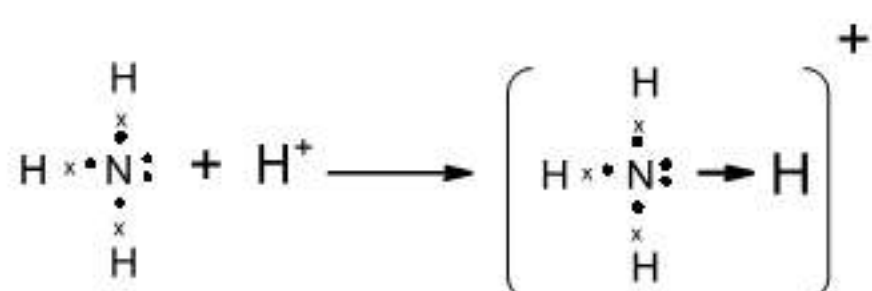
I. **Describe major properties of metals. (From book)**

II. **State four properties of ionic compounds. (From book)**

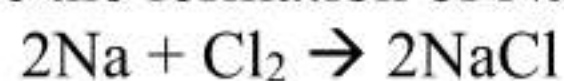
III. **How coordinate covalent bond is formed? Explain with examples.**

The type of covalent bonding in which the bond pair of electrons is donated only by one bonded atom. The atom which donates electron is called donor and which accepts electron is called acceptor. A small arrow is used to indicate the donation of electron from donor to acceptor.

When a proton (H^+) approaches ammonia (NH_3), it accept lone pair from NH_3 and form NH_4^+ ion as shown in diagram.

$$NH_3 + H^+ \longrightarrow [H_3N \rightarrow H]^+$$

IV. **Define the ionic bond. Explain it with the help of an example.**

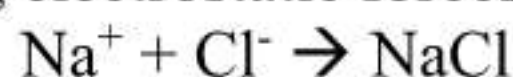
The bond formed by complete transfer of electron from an atom to another atom is called ionic bond. For example the formation of NaCl.

$$2Na + Cl_2 \rightarrow 2NaCl$$

Sodium has only one electron in its valance shell and it donates this electron easily and form a positive ion. At the same time chlorine has seven electron in its valance shell and needs one electron to complete its valence shell. It accepts this electron from sodium and form a negative ion.

$Na \rightarrow Na^+ + 1e^-$

$Cl + 1e^- \rightarrow Cl^-$

Both of these atoms are now changed into oppositely charged ions. They combine with each other due to strong electrostatic forces of attraction and ionic bond is formed.

$Na^+ + Cl^- \rightarrow NaCl$

PHYSICAL STATES OF MATTER

(1) Define a diffusion of gas with an example.

"The spontaneous (خودبخود) mixing up of molecules by random motion and collisions to form a homogeneous mixture".

Example:-

The spreading (پھیلنا) of fragrance (خوشبو) of rose.

(2) Define standard atmospheric pressure.

Standard atmospheric pressure can be defined as

"The pressure exerted (لگانا) by a mercury column of 760 mm height at sea level".

UNITS:-

Its various units are given here

1 atm = 760 torr = 760 mm of Hg = 76 cm of Hg (1 mm of Hg = One torr)

= 101325 Nm^{-2} = 101325 Pa (One Nm^{-2} = One Pa)

(3) Why are the densities of gases lower than that of liquids?

The densities of gases lower than that of liquids because they have light mass and occupies more volume due to presence of weak intermolecular forces.

(4) Define the term allotropy with examples.

"The existence of an element in more than one forms in same physical state is called allotropy". For example oxygen has two allotropes i.e. oxygen (O_2) and ozone (O_3).

(5) Why are the gases compressible?

Gases are compressible because there are large empty spaces between gas molecules due to presence of weak intermolecular forces.

(6) What is absolute zero?

"It is the temperature at which an ideal gas would have zero volume". Its value is zero kelvin (0 K) **or -273.15 °C.**

(7) What do you mean by condensation?

The process of changing gases or vapours into liquid state is called condensation.

(8) Why is the boiling point of water higher than that of alcohol?

The boiling point of water is higher than that of alcohol because intermolecular forces (i.e. Hydrogen bonding) are stronger in water as compare to alcohol.

(9) Define the boiling point of liquid.

"The temperature at which the vapour pressure of a liquid becomes equal to external atmospheric pressure is called boiling point of that liquid" e.g. boiling point of water is 100 °C at 1 atm pressure.

(10) Define the freezing point of liquid.

When vapour pressure of a liquid state becomes equal to the vapour pressure of the solid state this is called freezing point. For example freezing point of water is 0 °C.

(11) Define evaporation.

"The spontaneous process of changing of a liquid into vapours is called evaporation".

(12) What do you mean by vapour pressure?

The pressure exerted by the vapours of a liquid at dynamic equilibrium with the liquid at a particular temperature is called vapour pressure.

(13) Define Boyle's law.

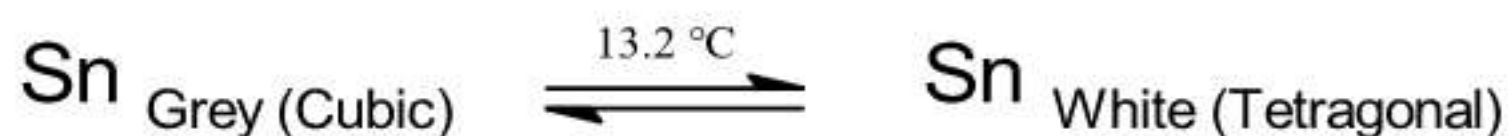
"The volume of a given mass of a gas is inversely proportional to its pressure provided the temperature remains constant".

Volume $\propto \frac{1}{\text{pressure}}$ or $V \propto \frac{1}{P}$

$V = \frac{k}{P}$ or $PV = k$

(14) Define transition temperature and give an example.

The temperature at which one allotrope changes into another is called ***transition temperature.***

$$Sn_{\text{Grey (Cubic)}} \overset{13.2\ ^\circ C}{\rightleftharpoons} Sn_{\text{White (Tetragonal)}}$$

(15) Define Charles's law.

"The volume of a given mass of a gas is directly proportional to the absolute temperature if the pressure is kept constant". Mathematically it can be written as

Volume $\propto$ Temperature represented as $V \propto T$

$V = kT$ or $k = \frac{V}{T}$

(16) What are amorphous solids? Give an example.

Those solids in which the particles are not regularly arranged are called amorphous solids. For example rubber glue etc.

(17) What are crystalline solids? Give examples.

Those solids in which the particles are regularly arranged are called crystalline solids. For example diamond, sodium chloride.

LONG QUESTIONS

I. Define Charles's law and derive its equation.
II. Explain Boyle's law and give its experimental verification.
III. Describe four factors which effect on the diffusions of liquids.
IV. Define boiling point and how it is affected by different factors?
V. Define vapour pressure and explain different factors on which is depends.
VI. Define evaporation. Explain the factors which effect on evaporation.

Temperature:

It increases with increase in temperature because at high temperature the kinetic energy of molecules increases and they overcome intermolecular forces.

Intermolecular forces:

It decreases with increase in strength of intermolecular forces. Polar liquid have strong intermolecular forces while non-polar have weak intermolecular forces. So it is larger for non-polar liquids and smaller for polar liquids.

Size of molecules:

It is smaller for large size molecules and vice versa.

SOLUTIONS

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(1) Why the suspensions does not form a homogeneous mixture.
The suspensions do not form a homogeneous mixture because its particles are big enough and remains undissolved.

(2) Why we stir paints thoroughly before using?
Paints are examples of suspensions. If we do not stir the paint before use, the particles will settle down.

(3) What do you mean by, like dissolves like? Explain with examples.
OR
What is general principle of solubility?
The general principle of solubility is "***Like dissolves like".***

- Ionic and polar substances are soluble in polar solvents
- Non-polar substances are soluble in non-polar solvents.

(4) Why is iodine soluble in CCl_4 and not in water?
Iodine is non-polar and soluble in non-polar solvent CCl_4. While water is polar solvent and iodine is non-polar. Therefore iodine is not soluble in water.

(5) Why test tube becomes cold when KNO_3 is dissolved in water.
When KNO_3 is dissolved in water test tube becomes cold because heat is absorbed.

(6) Why are the colloids quite stable?
Colloids are quite stable because particles of colloids do not settle down for a long time.

(7) Why does the colloid show Tyndall effect?
Colloid show Tyndall effect because there particles are large enough to scatter the beam of light.

(8) What is Tyndall effect and on what factors it depends?
"The scattering of the path of beam light by colloid particles is called Tyndall effect". It depends upon the size of particles in colloids.

(9) Define Molarity. Write its formula.
"Number of moles of solute dissolved in one dm^3 of the solution is called molarity". It is represented by M. The formula used for the preparation of molar solution is as follows.

$$\text{Molarity (M)} = \frac{\text{Mass of solute (g)}}{\text{Molar mass of solute}(\text{g mol}^{-1}) \times \text{Volume of solution (dm}^3)}$$

(10) Define percentage mass/mass (m/m%).
"The number of grams of solute in 100 gram of solution" Its general formula is

$$\%\text{ age}\frac{\text{m}}{\text{m}} = \frac{\text{Mass of solute (g)}}{\text{Mass of solution (g)}} \times 100$$

(11) Define percentage $\frac{\textbf{Mass}}{\textbf{Volume}}\left(\frac{\textbf{m}}{\textbf{v}}\%\right)$?
"The number of grams of solute dissolved in 100 cm^3 of the solution". Its general formula is

$$\%\text{ age}\frac{\text{m}}{\text{v}} = \frac{\text{Mass of solute (g)}}{\text{Volume of solution (cm}^3)} \times 100$$

(12) Define percentage $\frac{\textbf{Volume}}{\textbf{Mass}}\left(\frac{\textbf{v}}{\textbf{m}}\%\right)$?
"The volume in cm^3 of a solute dissolved in 100 g of the solution". Its general formula is

$$\%\text{ age}\frac{\text{v}}{\text{m}} = \frac{\text{Volume of solute (cm}^3)}{\text{Mass of solution (g)}} \times 100$$

(13) Define percentage volume/volume % (v/v%)?
"The volume in cm^3 of a solute dissolved per 100 cm^3 of the solution". Its general formula is

$$\%\text{ age}\frac{\text{v}}{\text{v}} = \frac{\text{Volume of solute (cm}^3)}{\text{Volume of solution (cm}^3)} \times 100$$

(14) Define solubility.

"The number of grams of the solute dissolved in 100 gram of a solvent to prepare a saturated solution at a specific temperature is called solubility".

(15) What is meant by aqueous solution? Give an example

"The solution in which water acts as solvent is known as aqueous solution". For example sugar in water and table salt in water.

(16) Define solute and solvent.

Solute:

"The component of solution which is present in smaller quantity is called solute".

Solvent:

"The component of solution which is present in larger quantity is called solvent".

For example salt solution is made by dissolving salt in water, here water is solvent and slat is solute.

(17) Define saturated solution.

"A solution containing maximum amount of solute at a given temperature is called saturated solution".

(18) Define supersaturated solution.

"The solution which is more concentrated than a saturated solution is called supersaturated solution".

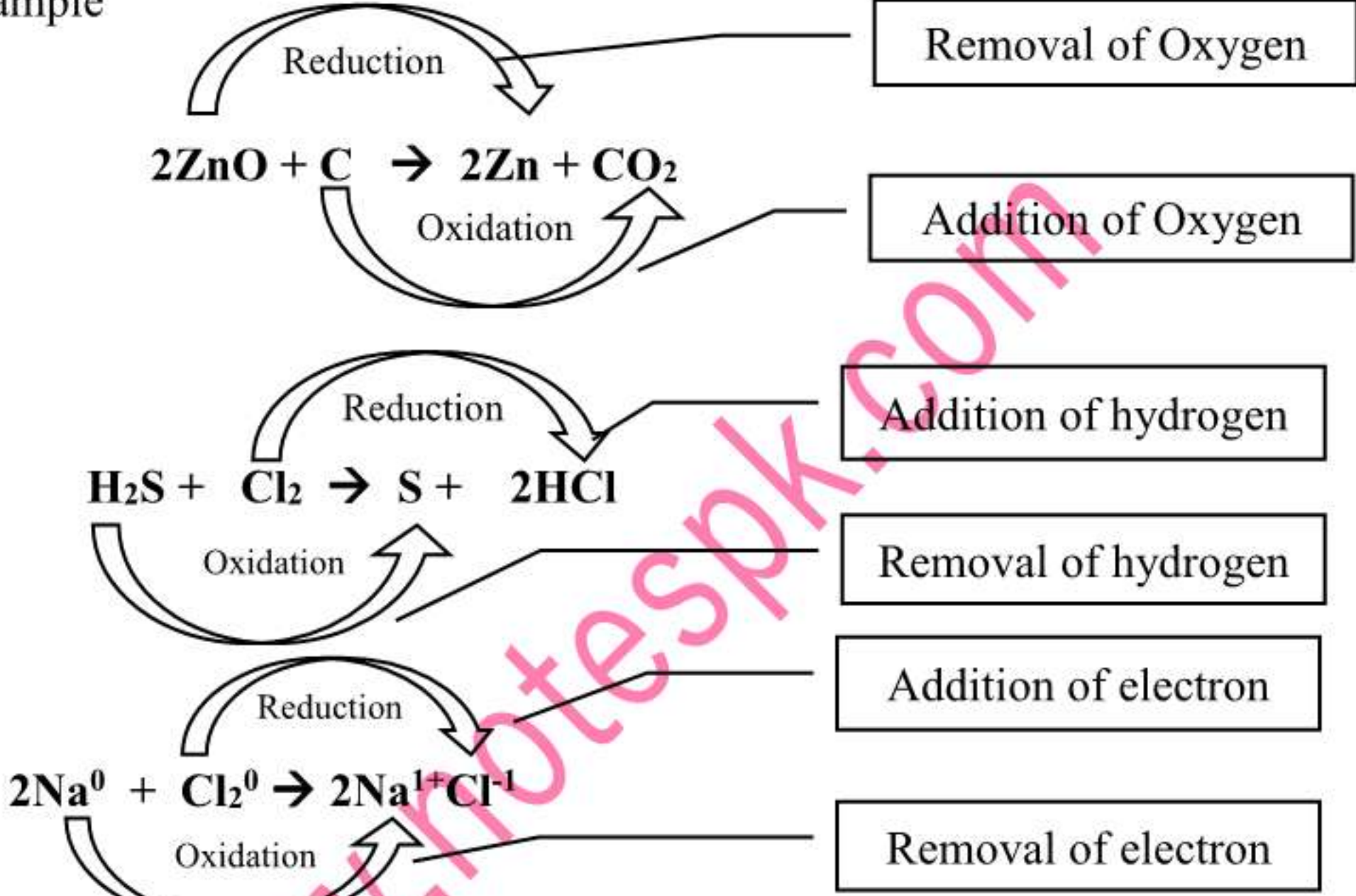
(19) Define unsaturated solution?

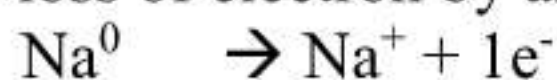
A solution which contains lesser amount of solute than that which is required to saturate it at a given temperature.

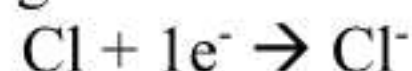
(20) What is difference between dilute and concentrated solution?

Sr. No	Dilute solution	Concentrated solution
1	Those solutions which have relatively small amount of solute are called dilute solutions.	Those solutions which have relatively large amount of solute are called concentrated solutions.

ELECTROCHEMISTRY

(1) Define oxidation and reduction in terms of electrons. Give an example.

The loss of electron by an atom or ion is called oxidation e.g.

$Na^0 \rightarrow Na^+ + 1e^-$

The gain of electron by an atom or ion is called reduction e.g.

$Cl + 1e^- \rightarrow Cl^-$

(2) Define oxidation and reduction with an example.

Sr. No	Oxidation	Reduction
1	The process in which oxygen is added or hydrogen or electron are removed is known as oxidation reaction.	The process in which oxygen is removed or hydrogen or electron are added is known as reduction reaction.
2	For example $2ZnO + C \rightarrow 2Zn + CO_2$ (Reduction: Removal of Oxygen; Oxidation: Addition of Oxygen) $H_2S + Cl_2 \rightarrow S + 2HCl$ (Reduction: Addition of hydrogen; Oxidation: Removal of hydrogen) $2Na^0 + Cl_2^0 \rightarrow 2Na^{1+}Cl^{-1}$ (Reduction: Addition of electron; Oxidation: Removal of electron)	

(3) Differentiate between strong and weak electrolytes.

Sr. No	Strong electrolytes	Weak electrolytes
1	The electrolytes which completely ionizes in their aqueous solution are called strong electrolytes.	The electrolytes which ionizes to a small extent in their aqueous solution are called weak electrolytes.
2	These are good conductors of electricity.	These are poor conductors of electricity.
3	For example solution of NaOH and HCl.	For example solution of CH_3COOH and $Ca(OH)_2$.
4	$NaOH \rightleftharpoons Na^+ + OH^-$	$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$

(4) Differentiate between electrolyte and non-electrolyte.

Sr. No	Electrolyte	Non–Electrolyte
1	The substances which can conduct electricity in their aqueous solutions or molten (پگھلی ہوئی حالت) state, are called electrolytes.	The substances which do not conduct electricity in their aqueous solutions or molten (پگھلی ہوئی حالت) state, are called non-electrolytes.

2	For example solution of salts, acids or bases.	For example sugar solution and benzene.

(5) Differentiate between spontaneous and non-spontaneous reaction.

Sr. No	Spontaneous reactions	Non-spontaneous reactions
1	The reactions which takes place by their own without any external agent, are called spontaneous reactions.	The reactions which cannot takes place by their own, are called non-spontaneous reactions.
2	For example reaction in Galvanic cell.	For example reaction in Nelson's cell and Downs cell.

(6) What is galvanizing? Why is galvanizing done?

Galvanizing is a process in which a thin Zinc layer is coated on iron sheet. It is done to protect iron from corrosion. It is done to protect iron from corrosion.

(7) Why is O_2 necessary for rusting?

Oxygen (O_2) is necessary for rusting because there is no rusting without oxygen.

(8) What is metallic coating?

The method in which a layers of metal is coated with another metal is called metallic coating. This is the best method for prevention from corrosion.

(9) Define electroplating. Give its uses.

"The process of depositing (جمانا) of one metal over the other by means of electrolysis is called as electroplating".

USES:

It is used for silver plating of jewelry, steel and tableware etc.

(10) How is electroplating of tin on steel carried out?

OR

How electroplating of tin is carried out?

- Electroplating of tin on steel is carried out by placing the steel into a container containing solution of tin salt.
- The steel is connected to an electrical circuit, acting as cathode. While the other electrode made of tin metal act as anode.
- When an electrical current is passed through the circuit, tin metal ions present in the solution deposit on steel.

(11) Define electrochemical cell. Write the names of its types.

"It is a system in which two electrodes are dipped in the solution of an electrolyte which are connected to the battery". It is an energy storage device. It has two types

i. Electrolytic cell **ii.** Galvanic cell

(12) Write two methods for prevention of corrosion.

The following methods are used for prevention of corrosion.

- Removal of stains
- Paints and greasing
- Alloying
- Metallic coating

(13) How galvanizing of iron sheets is done?

- The process of coating a thin layer of zinc on iron is called galvanizing.
- This process is carried out by dipping a clean iron sheet in a zinc chloride bath and then heating it.
- After this iron sheet is removed, rolled into molten zinc metal bath and finally air-cooled.

(14) What is the name of the by-product produced in the Downs cell?

Chlorine (Cl_2) is produced as a byproduct in Downs cell.

(15) Name the by-products produces in Nelson's cell?

Hydrogen gas (H_2) and chlorine gas (Cl_2) are the byproduct produced in Nelson's cell.

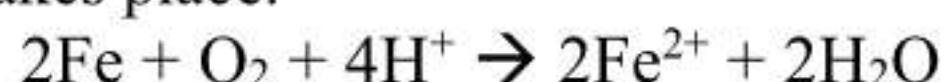
LONG QUESTIONS

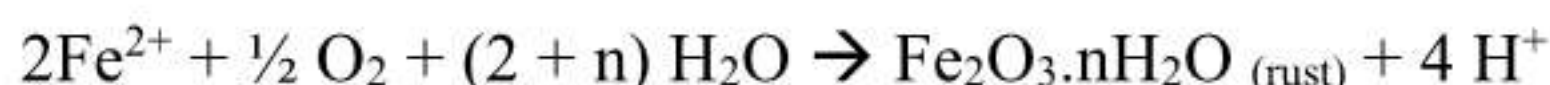
I. Write four rules for assigning oxidation numbers. **(From book)**

II. Discuss the electrolysis of water. **(From book)**

III. **What do you know about the rusting of iron?**

The corrosion of iron is called **rusting**. The important condition for rusting is moist air. There will be no rusting if water vapours or air is absent. Stains and dents on the surface of the iron provide the sites for rusting. This region is called anodic region. The loss of electron damages the object. These free electrons reach to an area of relatively high O_2 concentration which acts as cathode. The following redox reaction takes place.

$$2Fe + O_2 + 4H^+ \rightarrow 2Fe^{2+} + 2H_2O$$

The Fe^{+2} ions formed spreads throughout the surrounding water and reacts with O_2 to form the rust ($Fe_2O_3.nH_2O$).

$$2Fe^{2+} + \frac{1}{2} O_2 + (2 + n) H_2O \rightarrow Fe_2O_3.nH_2O_{\text{(rust)}} + 4 H^+$$

This process continues until the whole piece of iron is eaten away.

What is difference between electrolytic and galvanic cell?

Sr. No	Electrolytic cell	Galvanic cell
1	It consist of one complete cell.	It consist of two half cells.
2	Current is used to start a non-spontaneous chemical reaction.	Current is produced due to spontaneous chemical reaction.
3	Salt bridge is not used.	Salt bridge is used.
4	Electrical energy is converted into chemical energy.	Chemical energy is converted into electrical energy.
5	Anode has positive charge while cathode has negative charge.	Anode has negative charge while cathode has positive charge.

CHEMICAL REACTIVITY

(1) State two physical properties of the metals. (Also A long Question).

- They are good conductor of electricity.
- They have high melting & boiling point.
- Almost all the metals are solids (except mercury).
- They have high densities.

(2) Write any two chemical properties of metals. (Also A long Question).

- They form ionic compounds with non-metals.
- They easily lose electron and form positive ion.
- They react with water rapidly.
- They have metallic bonding.

(3) Write any two physical properties of non-metals. (Also A long Question).

- They are bad conductor of electricity.
- They have low melting and boiling point.
- They are brittle.
- They are not shiny.

(4) Write any two chemical properties of non-metals. (Also A long Question).

- They form ionic compounds with metals.
- They easily gain electron and form negative ion.
- They usually do not react with water.
- They don't react with dilute acids.

(5) Define metallic character.

OR

Define electropositive character. Write its trend.

Metals have the tendency to lose their valence electrons. This property of metals is called metallic character or electropositivity.

Trend:

Atomic size decreases along the period due to increase in nuclear charge so metallic character decreases along the period.

Atomic size increases down the group due to addition of extra shell so metallic character increases down the group.

(6) Why ionization energies of alkaline earth metals are higher than alkali metals?

The ionization energy of alkaline earth metals is higher than alkali metals because the size of alkaline earth metals is smaller and nuclear charge is higher than alkali metals.

(7) Why magnesium is harder than sodium?

Magnesium is harder than sodium because it forms strong metallic bonding than sodium.

(8) Why ionization energy of Na is less than Mg?

The ionization energy of Na (Sodium) is less than Mg (Magnesium) because the size of Na is larger and nuclear charge is less than Mg.

(9) Why the ionization energy of Na is more than K?

The ionization energy of Na (Sodium) is more than K (Potassium) because the atomic size of Na is smaller than K.

(10) Why sodium metal is more reactive than magnesium metal?

Sodium (Na) metal is more reactive than magnesium (Mg) because Na has larger size than Mg.

(11) Name the best ductile and malleable metal?

The best ductile and malleable metals are Gold (Au) and Silver (Ag).

(12) Why is gold used to make jewelry?

Gold is used to make jewelry because it is not even affected by any mineral acid or base.

(13) Why is platinum used for making jewelry?

OR

What are unique characteristics of platinum?

Platinum is used to make jewelry items because of its unique characteristics e.g. beauty, colour, flexibility (لچک), strength, and resistance to tarnish (تبدیل ہو جانا). It also provides a secure setting for diamonds and other gemstones (جواہرات) by enhancing their brilliance (چمک دمک).

(14) Give the applications (uses) of silver?

- It is used in making ornaments.
- Its alloys with copper are widely used in making coins.
- Its compounds are widely used in photographic films and dental preparations.
- It also have uses in mirror industry.

(15) Write the two uses of Magnesium.

- It is used in flash light bulbs and in fireworks.
- It is used in the manufacturing (تیار کرنا) of light alloys.
- In thermite process magnesium ribbon is used to ignite (جلانا) aluminum powder.

- It is used as anode for prevention of corrosion.

(16) Write two uses of calcium.

- It is used to remove Sulphur from petroleum products.
- It is used as reducing agent to produce Cr, U and Zr.

(17) Write two uses of sodium metal.

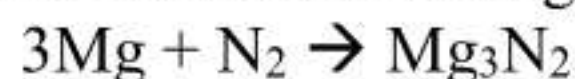
- In sodium vapour lamps it is used to produce yellow light.
- It is used as a reducing agent in the extraction of metals like Ti.

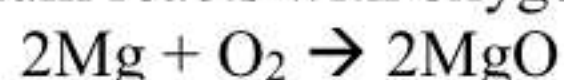
(18) Write two properties of silver metals.

- It is white lustrous metal.
- Excellent conductor of heat and electrolyte.
- It is highly ductile and malleable metal.
- Its polished surface is good reflector of light.

(19) Give the reaction of magnesium with O_2 and N_2.

Magnesium reacts with nitrogen and form stable nitrides.

$$3Mg + N_2 \rightarrow Mg_3N_2$$

Magnesium reacts with oxygen and form oxides.

$$2Mg + O_2 \rightarrow 2MgO$$

- Write a detail note on significance of non-metals.
- Write four physical properties of metals.
- Write four Chemical properties of metals.
- Write four physical properties of non-metals.
- Write four chemical properties of non-metals.

اِن چار long سوالوں کے جواب اوپر پہلے چار مختصر سوالوں میں موجود ہیں۔ آپ وہ چار مختصر سوال یاد کر لیں، آپ کا لونگ سوال بھی یاد ہو جائے گا۔

Student must learn the following statements for MCQs.

- The most abundant metal is **aluminium.**
- The most precious metal is **platinum.**
- The most useable metal is **iron.**
- The most reactive metal is **cesium.**
- The most valuable metal is **uranium.**
- The lightest metal is **Lithium.**
- The heaviest metal **is Osmium.**
- The least conductor of heat is **lead.**
- The best conductor metals are **silver** and **gold**.
- The most ductile and malleable metals are **silver** and **gold**.

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معزز اساتذہ کرام، السلام علیکم ورحمۃ اللہ! گزارش ہے کہ سٹوڈنٹس کو مطالعہ سے پہلے درج ذیل دعاؤں کو باقاعدگی سے پڑھنے کی ترغیب دیں۔ جزاک اللہ۔

عزیز طلبا و طالبات، آپ سب بھی دعاؤں کا اہتمام ضرور کریں۔ اللہ تعالیٰ آپ سب کے اور اساتذہ کرام کے علم، زندگی اور ایمان میں برکت دے۔ آمین۔

ہمارے لیے بھی دعا کرتے رہیں۔ اللہ تعالیٰ ہم سب کے لیے دنیا و آخرت میں آسانیاں اور سکون نصیب فرمائے۔

بِسْمِ اللّٰہِ الرَّحْمٰنِ الرَّحِیْمِ ط

اللہ کے نام سے شروع جو رحمٰن و رحیم ہے۔

اَللّٰھُمَّ صَلِّ عَلٰی مُحَمَّدٍ وَّعَلٰٓی اٰلِ مُحَمَّدٍ کَمَا صَلَّیْتَ عَلٰٓی اِبْرٰھِیْمَ وَعَلٰٓی اٰلِ اِبْرٰھِیْمَ اِنَّکَ حَمِیْدٌ مَّجِیْدٌ ○ اَللّٰھُمَّ بَارِکْ عَلٰی مُحَمَّدٍ وَّعَلٰٓی اٰلِ مُحَمَّدٍ کَمَا بَارَکْتَ عَلٰٓی اِبْرٰھِیْمَ وَعَلٰٓی اٰلِ اِبْرٰھِیْمَ اِنَّکَ حَمِیْدٌ مَّجِیْدٌ ○

رَبِّ اشْرَحْ لِیْ صَدْرِیْ ○ وَیَسِّرْ لِیْٓ اَمْرِیْ ○ وَاحْلُلْ عُقْدَۃً مِّنْ لِّسَانِیْ ○ یَفْقَھُوْا قَوْلِیْ ○

رَبِّ زِدْنِیْ عِلْمًا۔ رَبِّ زِدْنِیْ عِلْمًا۔ رَبِّ زِدْنِیْ عِلْمًا۔

اَللّٰھُمَّ اِنِّیْٓ اَسْئَلُکَ عِلْمًا نَّافِعًا وَّرِزْقًا طَیِّبًا وَّ عَمَلًا مُّتَقَبَّلًا ○

آخر میں درود شریف دوبارہ پڑھیں۔

اللہ تعالیٰ آپ کو جزا دے، آپ کے علم کے حصول میں آسانیاں عطا فرمائے۔